

## **REMARKS**

In the final Office Action, the Examiner objected to claims 14-33 for various informalities; objected to the drawings under 37 C.F.R. 1.83(a); rejected claims 14-31 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,270,257 to Shin ("Shin") in view of U.S. Patent No. 5,949,116 to Wen ("Wen"); and rejected claims 32-33 under 35 U.S.C. § 103(a) as being unpatentable over Shin in view of Wen, and further in view of U.S. Patent No. 6,228,763<sup>1</sup> to Lee ("Lee").

By this amendment, Applicants have amended claims 14, 18, 22, 23, 24, 27, 28, 29, 31, and 32. Applicants have canceled claims 30 and 33. Claims 14-29, 31, and 32 are currently pending in this application.

### **I. Interviews of March 10, 2005, and March 15, 2005**

Applicants thank the Examiner for courtesy of the interviews conducted on March 10, 2005, and March 15, 2005, the summary of which follows:

On March 10, 2005, the Examiner contacted Applicants' representative to discuss possible claim amendments that the Examiner believed would have placed the claims in condition for allowance. The possible claim amendments including narrowing at least the independent claims to recite specific elements of the disclosed embodiments to which the claim corresponds. For example, the Examiner proposed amending "first film," as recited in claim 18 to --SiO<sub>2</sub>-- film. As a result of the Examiner's discussion, Applicants' representative indicated that the Applicants must be contacted to determine if Applicants would agree with such an amendment.

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<sup>1</sup> Although in the outstanding Office Action the Examiner cited U.S. Patent No. 6,248,622, attributed to Lee, it is believed that the Examiner meant to cite U.S. Patent No. 6,228,763 also attributed to Lee, as in previous Office Actions.

On March 15, 2005 Applicants' representative replied to the Examiner, and indicated that Applicants did not agree with the Examiner's proposed amendments. Moreover, Applicants believed that the suggested amendments would unnecessarily limit the subject matter that Applicants have a right to claim. Accordingly, no agreement was reached with respect to the claims.

## II. Claim Objections

In the Office Action, the Examiner objected to claims 14-33 for various informalities. Specifically, the Examiner objected to independent claims 14, 18, 22, 27, and 32 "because consistent terminology is not used to identify same elements in the claims." Office Action, page 2. Applicants respectfully submit that the amendments to the claims have addressed the Examiner's concerns regarding "consistent terminology."

The Examiner additionally objected to claim 18 separately, asserting "the first film should be identified as 'first oxide film.'" *Id.* Applicants disagree with this assertion because the Examiner's position is not consistent with standard patent practice, as detailed in the MPEP. For example, MPEP § 2163.02 states:

[t]he subject matter of the claim need not be described literally (i.e. using the same terms or *in haec verba*) in order to satisfy the description requirement.

Similarly, MPEP § 2164.08 states:

[l]imitations and examples in the specification do not generally limit what is covered by the claims.

Accordingly, Applicants respectfully submit that the Examiner's objection of claim 18 has no basis in the MPEP, and is therefore improper.

Furthermore, the Examiner has separately objected to claim 22, stating that "[c]laim 22 after 5 is missing steps [l]ike etching step, second film formation step...."

Office Action, page 3. Applicants disagree with the Examiner's assertion, and respectfully submit that claim 22 is not missing steps. Claim 22 is directed to an embodiment of the invention described in Applicants' specification at, e.g., pages 12-14, and Figures 4A-4E. This claimed embodiment does not necessarily require an "etching step, second film formation step," and thus Applicants submit that claim 22 is not "missing steps."

Accordingly, in view of claim amendments, and the above arguments, Applicants respectfully request that the Examiner withdraw all claim objections.

### **III. Objections to the Drawings**

With respect to the Examiner's objection to the drawings, the Examiner appears to be asserting that all of the elements of each of the independent claims are not completely shown in a single Figure. Specifically, the Examiner states: "claim 18 seems to recite steps ... that are described in figs. 3A to 3C and then recite steps that are shown 6D and 6E." Office Action, page 4. Applicants respectfully disagree with the Examiner's assertion, and submit that the steps shown in the embodiment illustrated in Figs. 3A-3C are utilized in other embodiments of Applicants' invention. For example, the steps shown in Figs. 3A-3C also correspond to the steps of another embodiment covered by, e.g., claim 18. In particular, Figs. 3A-3C correspond to the steps of "selectively forming a first film on said semiconductor substrate;" and "etching said semiconductor substrate to form a first groove by using said first film as a mask," as recited in claims 14 and 18. Moreover, the specification at, for example, page 15, lines 16-19, states with respect to the embodiment that the steps shown in Figs. 6A-6C "**are**

***substantially the same as those in the method of producing the first or second preferred embodiment***" (emphasis added).

Moreover, Applicants respectfully submit that the Examiner's assertion does not agree with standard U.S. patent practice. 37 CFR 1.83(a) states:

[t]he drawing in a nonprovisional application must show every feature of the invention specified in the claims. However, conventional features disclosed in the description and claims, where their detailed illustration is not essential for a proper understanding of the invention, should be illustrated in the drawing in the form of a graphical drawing symbol or a labeled representation (e.g., a labeled rectangular box).

Applicants note that 37 CFR 1.83(a) does not state that all of the elements of a claim must be shown in a single Figure, as asserted by the Examiner. If the Examiner is to maintain his objection to the drawings, Applicants request that the Examiner provide a citation to either the Rules, the Statute, or the MPEP, to a requirement that a single Figure show every element of a claim.

Applicants respectfully submit, in conjunction with the discussion of specific elements above, that Applicants' claimed elements are shown in the Figures of this application (collectively, "the drawing"), and thus comply with 37 CFR 1.83(a).

Therefore, Applicants respectfully request that the objection to the drawings be withdrawn.

#### **IV. Rejections under 35 U.S.C. § 103(a)**

Regarding the Examiner's rejection of claims 14-33 under 35 U.S.C. § 103(a), Applicants respectfully disagree with the Examiner's conclusions and assertions as set forth in the Office Action. Accordingly, Applicants respectfully traverse this rejection on the ground that the Examiner has failed to establish a *prima facie* case of obviousness.

To establish a *prima facie* case of obviousness under 35 U.S.C. §103(a), each of three requirements must be met. First, the reference or references, taken alone or combined, must teach or suggest each and every element recited in the claims. See M.P.E.P. §2143.03 (8<sup>th</sup> ed., 2001). Second, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to combine the references in a manner resulting in the claimed invention. Third, a reasonable expectation of success must exist. Moreover, each of the three requirements must “be found in the prior art, and not be based on applicant’s disclosure.” See M.P.E.P. § 2143 (8<sup>th</sup> ed., 2001). At a minimum, the Examiner cannot establish that the references teach each and every element of the claims.

A. Claims 14 and 18

Regarding the Examiner’s rejection of independent claims 14 and 18 under 35 U.S.C. § 103(a) as being unpatentable over Shin in view of Wen, each of claims 14 and 18 recites a combination including “removing said second film to form a second groove on the semiconductor substrate ...; [and] forming a gate insulator film in said second groove.” The references, whether taken alone or in combination, fail to teach or suggest at least this element.

The Examiner states: “Shin does not specifically disclose the steps of ... removing said second film to form a second groove in the semiconductor substrate.” Office Action, page 5. The Examiner alleges that Wen cures the deficiencies of Shin. Specifically, the Examiner states that Wen teaches “removing the second film to form a second groove,” citing Figure 2C, wherein elements 201 and 207,

as the “second film” are removed to form a second groove element 209 of Figure 2C.

The Examiner further alleges that Wen teaches or suggests the limitation “forming a gate insulator film in said second groove” at elements 210, 211 in Figs. 2D to 2F.

Contrary to the Examiner’s allegation, 210 is an insulating layer, and 211 is a conductive layer, which together constitute part of the source/drain region, and not part of the gate structure. Wen, col. 3, lines 23-24. Moreover, since elements 210 and 211 are formed outside of the region beneath gate 204, and not between the source and drain regions, elements 210 and 211 cannot act as a gate structure. Thus, the Examiner has mischaracterized Wen, and elements 210 and 211 cannot constitute “a gate insulator film” formed in a second groove. Accordingly, Wen does not teach or suggest “removing said second film to form a second groove on the semiconductor substrate ...; [and] forming a gate insulator film in said second groove” as recited in claims 14 and 18, and thus does not cure the deficiencies of Shin.

Since the references, whether taken alone or in combination, fail to teach or suggest each and every element of independent claims 14 and 18, the Examiner has failed to establish a *prima facie* case of obviousness. Accordingly, Applicants respectfully request that the rejection of independent claims 14 and 18 under 35 U.S.C. § 103(a) be withdrawn.

Claims 15-17 depend from independent claim 14. Claims 19-21 depend from independent claim 18. Since Shin in view of Wen fails to teach or suggest each and every element of independent claims 14 and 18, that combination of references also fails to teach or suggest each and every element required by the dependent claims.

Accordingly, Applicants respectfully request that the rejection of claims 15-17 and 19-21 under 35 U.S.C. § 103(a) be withdrawn.

B. Claim 22

Regarding the Examiner's rejection of independent claim 22 under 35 U.S.C. § 103(a) as being unpatentable over Shin in view of Wen, claim 22 recites a combination including "controlling a thickness of the gate insulator film so that a top surface of said gate insulator film is higher than a top surface of said impurity diffusion region." Similarly to claims 14 and 18, the references, either taken alone or in combination, fail to teach or suggest at least this element. Specifically, even if gate oxide film 23 of Shin (Figure 3b) is considered to be a gate insulator film formed in a groove, the thickness of the alleged gate insulator film 23 is not such that the top surface of the gate insulator film is higher than a top surface of the impurity diffusion region (elements 26a,b in Figure 3c).

Wen does not cure this deficiency. The Examiner alleges that elements 210 and 211 as shown in Figs. 2D to 2F constitute a gate structure comprising insulating layer 210 as a gate insulating layer, and conductive element 211 as a gate. Office Action, page 6. For reasons similar to those given above in the discussion of claims 14 and 18, elements 210 and 211 cannot constitute a gate structure. In any event, to the extent the insulator 210 and conductor 211 correspond to the Examiner's alleged gate structure, the layers are formed such that the top surface of 210, 211, as shown in Fig. 2D, is below a top surface of the impurity diffusion region 217 (see Fig. 3). Accordingly, Wen fails to teach or suggest "controlling a thickness of the gate insulator film so that a top

surface of said gate insulator film is higher than a top surface of said impurity diffusion region,” (emphasis added) as recited in independent claim 22.

Since the references, whether taken alone or in combination, fail to teach or suggest each and every element required by independent claim 22, the Examiner has failed to establish a *prima facie* case of obviousness. Accordingly, Applicants respectfully request that the rejection of independent claim 22 under 35 U.S.C. § 103(a) be withdrawn.

Claims 23-26 depend from claim 22, and thus require all of the elements of claim 22. Since Shin in view of Wen fails to teach or suggest each and every element of independent claim 22, that combination of references also fails to teach or suggest each and every element required by the dependent claims. Accordingly, Applicants respectfully request that the rejection of claims 23-26 under 35 U.S.C. § 103(a) be withdrawn.

C. Claim 27

Regarding the rejection of independent claim 27 under 35 U.S.C. § 103(a) as being unpatentable over Shin in view of Wen, claim 27 recites a combination including “controlling a thickness of elevated impurity diffusion region by using said gate insulator film as a mask, so that a top surface of the gate insulator film is higher than a top surface of the elevated impurity diffusion region.” The references, whether taken alone or in combination, fail to teach or suggest at least this element.

Shin teaches forming a gate oxide layer 23 (Fig. 3b) in a groove, and then forming polysilicon gate 24 on top of gate oxide layer 23. Nitride layer 22 is then removed, and the exposed portion of polysilicon gate is oxidized to form oxide layer 25



(Fig. 3c), "to make the remaining gate oxide layer 23 good quality." Shin, col. 4, lines 40-44. Source and drain regions 26a,b and 28a,b (Fig. 3e) are subsequently formed such that the source and drain regions are higher than a top surface of the original gate oxide layer 23, but not higher than the oxide layers 23, 25 that surround polysilicon gate 24. Shin further teaches ion-injecting a dopant through oxide layer 25 to form low concentration source/drain regions 26a,b (Fig. 3c), so oxide layer 25 is not used as a mask. Moreover, Shin teaches that ion implantation can be performed earlier in the formation process, e.g., prior to the deposition of nitride layer 22. Shin, col. 4, lines 48-54. Thus, there is no consideration in Shin of using either of oxide layers 23, 25 to control the thickness of the impurity diffusion region 26a,b. Accordingly, Shin fails to teach or suggest the element "controlling a thickness of elevated impurity diffusion region by using said gate insulator film as a mask, so that a top surface of the gate insulator film is higher than a top surface of the elevated impurity diffusion region," as recited in independent claim 27.

Wen fails to cure the deficiencies of Shin. Wen teaches depositing a conductive layer 212 (Fig. 2E), formed of highly doped polysilicon on the upper surface of conductive layer 211. Wen, col. 3, lines 6-10. The highly concentrated dopant contained in conductive layer 212 then diffuses into the substrate to form an impurity diffusion region 217. Wen, col. 3, lines 15-18. Since the formation of impurity diffusion region 217 does not require an oxide or other insulator, Wen, does not teach using a "gate insulator film as a mask," as recited in claim 27. Accordingly, Wen fails to cure the above-noted deficiencies of Shin by failing to teach or suggest at least the element, "controlling a thickness of elevated impurity diffusion region by using said gate insulator

film as a mask, so that a top surface of the gate insulator film is higher than a top surface of the elevated impurity diffusion region,” as recited in independent claim 27.

D. Claim 32

Regarding the Examiner’s rejection of independent claim 32 under 35 U.S.C. § 103(a) as being unpatentable over Shin in view of Wen and further in view of Lee, claim 32 recites a combination including “selectively depositing semiconductor layers serving as said source/drain regions so that an inclined surface is formed between the top surface of said semiconductor layers and said channel region.” The references, whether taken alone or in combination, fail to teach or suggest this element.

Shin teaches the formation of source/drain regions 26a,b and 28 a,b (Fig. 3e) on top of semiconductor substrate 21 (as shown in Fig. 3a). While it appears a surface of source 26a and drain 26b is inclined, the “top surface” of the semiconductors layers is a top surface of source 28a and drain 28b, which are on top of source 26a and drain 26b, respectively. On this basis, Shin fails to teach or suggest “selectively depositing semiconductor layers ... so that an inclined surface is formed between the top surface of said semiconductor layers and said channel region,” as recited in independent claim 32.

Wen fails to cure the above-noted deficiencies of Shin. Wen shows diffusion regions 200 and 217, but fails to show “an inclined surface” between these regions and a region beneath gate oxide 203 that may correspond to a channel region. Lee, cited only for the T-shaped cross-section, does not cure the above-noted deficiencies of Shin and Wen, and is not relied upon by the Examiner for such teachings. Accordingly, neither Wen, nor Shin teach or suggest at least the element “selectively depositing

semiconductor layers serving as said source/drain regions so that an inclined surface is formed between the top surface of said semiconductor layers and said channel region,” as recited in claim 32, and thus do not cure the above-noted deficiencies of Shin.

Since the references, whether taken alone or in combination, fail to teach or suggest each and every element of claim 32, the Examiner has failed to establish a *prima facie* case of obviousness. Accordingly, Applicants respectfully request that the rejection of claim 32 under 35 U.S.C. § 103(a) be withdrawn.

Applicants respectfully request that this Amendment under 37 C.F.R. § 1.116 be entered by the Examiner, placing claims 14-29, 31, and 32 in condition for allowance. Applicants submit that the proposed amendments of claims 14, 18, 22, 23, 24, 27, 28, 29, 31, and 32 do not raise new issues or necessitate the undertaking of any additional search of the art by the Examiner, since all of the elements and their relationships claimed were either earlier claimed or inherent in the claims as examined. Therefore, this Amendment should allow for immediate action by the Examiner.

Moreover, Applicants submit that the entry of the amendment would place the application in better form for appeal, should the Examiner dispute the patentability of the pending claims.

In view of the foregoing remarks, Applicants submit that this claimed invention, as amended, is neither anticipated nor rendered obvious in view of the prior art references cited against this application. Applicants therefore request the entry of this Amendment, the Examiner's reconsideration and reexamination of the application, and the timely allowance of the pending claims.

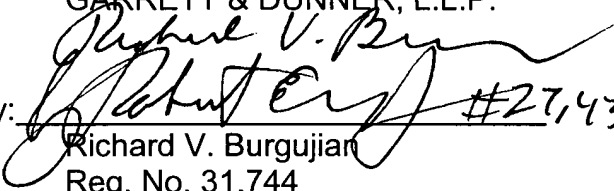
Please grant any extensions of time required to enter this response and charge any additional required fees to our deposit account 06-0916.

Respectfully submitted,

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